

Graph Theory Quiz Questions and Answers PDF

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What is a tree in graph theory?

- A graph with cycles
- A connected graph with no cycles ✓
- A graph with multiple components
- A graph with weighted edges

In graph theory, a tree is a connected graph with no cycles, meaning there is exactly one path between any two vertices. It has the property that if there are n vertices, there are exactly $n-1$ edges.

What is the degree of a vertex in a graph?

- The number of vertices in the graph
- The number of edges in the graph
- The number of edges incident to the vertex ✓
- The number of cycles in the graph

The degree of a vertex in a graph is the number of edges connected to that vertex. It indicates how many direct connections a vertex has within the graph.

Describe how graph coloring can be applied to solve scheduling problems.

Graph coloring assigns colors to vertices such that no two adjacent vertices share the same color, which can be used to schedule tasks without conflicts.

What is a Hamiltonian circuit?

- A path that visits every edge once
- A path that visits every vertex once
- A circuit that visits every vertex once ✓**
- A circuit that visits every edge once

A Hamiltonian circuit is a path in a graph that visits each vertex exactly once and returns to the starting vertex. It is a specific type of cycle that is significant in graph theory and combinatorial optimization.

Explain the difference between a Hamiltonian path and an Eulerian path.

A Hamiltonian path visits each vertex exactly once, whereas an Eulerian path visits every edge exactly once.

Which of the following are characteristics of a complete graph? (Select all that apply)

- Every pair of distinct vertices is connected by a unique edge ✓**
- It contains cycles ✓**
- It is always a tree
- It can be directed or undirected ✓**

A complete graph is characterized by having an edge between every pair of vertices, meaning it is fully connected. Additionally, the number of edges in a complete graph with n vertices is given by the formula $n(n-1)/2$.

Which of the following are true about Eulerian paths? (Select all that apply)

- They visit every vertex exactly once
- They visit every edge exactly once ✓**
- They can exist in both directed and undirected graphs ✓**
- They require all vertices to have even degree

Eulerian paths are trails in a graph that visit every edge exactly once. They exist if and only if at most two vertices have an odd degree, and all vertices with non-zero degree are connected.

Which of the following is a representation of a graph?

- Matrix
- Tree
- List
- Both A and C ✓**

A graph can be represented in various forms, such as a visual diagram, a set of points plotted on a coordinate system, or an adjacency list in computer science. Each representation serves to illustrate relationships between data points or variables effectively.

Discuss the importance of graph isomorphism and provide an example of when it might be used.

Graph isomorphism determines if two graphs are structurally identical, which is important in chemistry for identifying molecules with the same structure.

How does Dijkstra's Algorithm work, and what are its limitations?

Dijkstra's Algorithm finds the shortest path from a source vertex to all other vertices in a weighted graph. It cannot handle graphs with negative weight edges.

Provide a real-world example of a problem that can be solved using minimum spanning tree algorithms.

Minimum spanning tree algorithms can be used to design the most efficient network of roads or cables with the least total cost.

Which of the following are types of graph traversal algorithms? (Select all that apply)

- Breadth-First Search ✓
- Depth-First Search ✓
- Kruskal's Algorithm
- Dijkstra's Algorithm

Graph traversal algorithms are essential techniques used to explore nodes and edges in a graph. The most common types include Depth-First Search (DFS) and Breadth-First Search (BFS).

Which type of graph has edges with directions?

- Undirected Graph
- Directed Graph ✓
- Weighted Graph
- Complete Graph

Graphs that have edges with directions are known as directed graphs or digraphs. In these graphs, each edge has a specific direction indicating a one-way relationship between the vertices it connects.

What are the applications of graph theory? (Select all that apply)

- Network Analysis ✓
- Biological Networks ✓
- Social Networks ✓
- Linear Regression

Graph theory has a wide range of applications including computer science, social network analysis, transportation, and biology. It is used to model relationships and solve problems related to connectivity and optimization.

Which algorithms are used to find a minimum spanning tree? (Select all that apply)

- Dijkstra's Algorithm
- Kruskal's Algorithm ✓**
- Prim's Algorithm ✓**
- Bellman-Ford Algorithm

Common algorithms used to find a minimum spanning tree include Prim's algorithm and Kruskal's algorithm. Both are efficient methods for determining the minimum spanning tree in a weighted graph.

What is the significance of Euler's work on the Seven Bridges of Königsberg in the development of graph theory?

Euler's solution to the problem of the Seven Bridges of Königsberg is significant as it marked the birth of graph theory, where he formulated the first principles of what would later become a fundamental area of mathematics.

Which algorithm is used to find the shortest path in a weighted graph?

- Prim's Algorithm
- Kruskal's Algorithm
- Dijkstra's Algorithm ✓**
- Depth-First Search

Dijkstra's algorithm is a popular method for finding the shortest path in a weighted graph, efficiently calculating the minimum distance from a starting node to all other nodes.

Which graph property ensures that there is a path between every pair of vertices?

- Complete Graph
- Planar Graph
- Connected Graph ✓**
- Eulerian Graph

The property that ensures there is a path between every pair of vertices in a graph is called 'connectedness.' A graph is connected if there is a path between any two vertices.

Which statements are true about planar graphs? (Select all that apply)

- They can be drawn without any edges crossing ✓**
- They always have an Eulerian circuit
- They can be represented in three dimensions without crossings
- They have a maximum of $3n - 6$ edges, where n is the number of vertices ✓**

Planar graphs can be drawn on a plane without any edges crossing, and they satisfy specific properties such as Euler's formula. Additionally, they can be characterized by the absence of certain subgraphs, like K_5 and $K_{3,3}$, which are non-planar.

What is a graph in graph theory?

- A collection of numbers
- A set of vertices and edges ✓**
- A type of tree
- A single line

A graph in graph theory is a mathematical structure consisting of a set of vertices (or nodes) connected by edges (or links). It is used to model pairwise relationships between objects.